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INTRODUCTION

Range cattle provide room and board for a large variety of flatworm and roundworm parasites. A parasite is by definition an agent that inflicts a degree of harm to a host, and the damage caused depends on the innate abilities, size of the population, duration of infection and other factors tied to the parasite. Host-related factors are also important, including breed, age, sex and condition. The damage to animals may be obvious, with clinical signs including diarrhea, loss of weight, "bottle jaw" (swelling under the jaw), rough hair coat, reproductive/breeding dysfunction and, in severe cases, feed waste due to an inability to digest protein, depressed lactation in cows and diminished immune response to viral, bacterial and mycotic opportunists.

The roundworms known as trichostrongylids are widely known to be the most common and economically important group of worms in cattle in the world (ARS, NRP #20420, USDA 1976). Members of the group inhabit the abomasum (*Ostertagia* species, *Trichostronglus axei* and *Haemonchus* species), small intestine (*Cooperia* species, *Nematodirus* species and *Trichostrongylus colubriformis*) and the lungs (*Dictyocaulus* species). They range from about the size of an eyelash to more than an inch in length and damage the lining of the organ they inhabit by burrowing through cell layers or feeding on blood or tissues. Although liver fluke or lungworm can be a significant problem in local areas, the magnitude of importance warrants focus on the abomasal/intestinal trichostrongylids, especially *Ostertagia ostertagi* the medium stomach worm.

LIFE HISTORIES

The trichostrongylids infect range cattle by contaminating the vegetation eaten by grazing animals. Adult worms in the abomasum and small intestine produce eggs that pass into the pasture with manure. During warm, humid weather the eggs hatch and infective larvae develop within a few days. The infective larvae face many survival hazards, including predatory fungi, arthropods, sunlight and drying conditions; they also risk starvation due to depletion of nutrient stored in their bodies, on which they must depend until they gain entry into a bovine host. After developing to an infective larva, they must distance themselves from the manure pile, far enough to reach vegetation that the cattle will eat; rain, irrigation, birds, arthropods, trampling hooves and vehicles/machinery aid their migration. Once in an area likely to be fed on, they migrate up the plant stems in a moisture film, supplied by rain, irrigation or dew. Hot, dry or cold, dry weather is detrimental or lethal to both eggs and larvae, although enough moisture and warmth is present in a fresh manure pile to allow the eggs to develop to the hatching stage.

Upon entering a cow or calf, the larva develops to an adult worm through 2 stages, requiring only a few days under ideal conditions. The environmental conditions in the pasture affect much of the development of the worm inside the animal, especially with *Ostertagia*. For example, during the grazing season, which spans roughly May until October in northern, and September until about April in southern states in the USA, *Ostertagia* can develop from the infective larva to egg-producing, adult worms in 3 to 4 weeks. In contrast, during the hot, dry season from April until October in southern, and the cold, winter months in northern states, the larvae of *Ostertagia* suspend development in the lining of the abomasum, deep in the acid-producing gastric glands of the bovine. When the inclement weather breaks, the larvae burrow to the surface of the stomach and continue development, thereby saving their reproductive potential for conditions that favor their survival. While in the arrested larval stage, they may accumulate in number to where they inhibit acid secretion, raising the pH (acidity) of the abomasum to the detriment of the normal ability of the stomach to digest protein.

EPIDEMIOLOGY

As already explained, pasture environmental conditions affect the development, population levels and cycles of the worms. Management methods may also aid or otherwise affect worm infections. Stocking rates and pasture rotation, for example, can significantly enhance or retard the buildup of infective larvae on forage. All cattle, despite control attempts, appear to harbor a few or many worms that will produce the eggs that will, in turn, lead to a buildup of infective larvae in a pasture. Irrigation practices, for another example, aid the worms as much as they do the herbage, in development and production.

DIAGNOSIS

Diagnosis of infections in cattle conventionally relies on an analysis of fresh fecal samples. A small specimen is measured and processed to separate the eggs, which are counted, from the debris in the manure, and the number of eggs per gram of feces is used as an estimate of worm load. The problem with the method is the eggs are produced only by adult worms, and the egg count gives no indication of the numbers of larvae present. During the grazing season, the egg counts are useful, but during the hot-dry, or cold-dry seasons when little pasture transmission is occurring, the numbers of inhibited larvae can accumulate to levels far exceeding total worm numbers of any other time of the year. At that time, the only way to determine the true degree of infection is to examine the lining of the abomasum for inhibited larvae, seen as raised bumps with tiny pits in the centers (*Ostertagia*) or as small, fine hairs, attached to the lining of the stomach (*Haemonchus*). A survey of 208 cattle from 7 months to over 8 years of age was recently completed in Wyoming, by necropsy examination of abomasum and small intestine for larval and adult worms, and flotation of feces for eggs. About 17 animals were examined each month from January through December to determine worm numbers and stages present. All animals harbored *Ostertagia*. and the total number of worms was highest in January, when fecal egg counts were lowest, due to high numbers of inhibited larvae and low numbers of adult worms (Malczewski, Jolley, Woodard, 1991).

CONTROL

If "clean" cattle could be maintained on "clean" pastures, parasitism of many types would be ideally controlled, and therein lies the basic strategy for management. Practically however, few or no cattle are "clean" (free of worms, protozoa or arthropods) and neither are pastures, due to wild, feral or domestic animal exposure, and it is only a matter of time after the introduction of cattle, until the population of worms builds up, in the vegetation first and then in the grazing animals.

After cattle reach full growth and as they age, they acquire a degree of immunity and are somewhat less adversely affected than calves or yearlings. Nutrition and all types of stress continue to affect the worm-cow/calf relationship. Practical attempts at control aim at, 1) relieving or preventing direct pathologic effects of adult and/or larval worms on infected animals and 2) preventing or slowing the buildup of infections in the pasture by eliminating as many egg-laying adults as possible.

Elimination by drug treatment, of most of the inhibited *Ostertagia* and other larvae that accumulate in cattle at the end of the grazing season accomplishes at least 3 important objectives: 1) the pH of the abomasum will function normally at its proper level, optimally contributing the digestion of protein in the feed provided, 2) pregnant animals will more efficiently support gestation, contributing to a healthier calf at parturition, and 3) fewer inhibited larvae will be available to contribute to production of type 2 ostertagiasis, a disease that results in heavily infected calves when many inhibited larvae burst from the stomach lining into the lumen in a short period of time, at the end of the period of inhibition.

Treatment of cattle prior to turn-out is intended to prevent or delay pasture contamination, as much as to relieve the animals of worm burden. If early calves have begun to nibble vegetation prior to turn-out, treatment of the calves is also often done. Ideally, worms can be controlled and performance enhanced by deworming every 5 or 6 weeks after the treatment at turn-out, but with the impracticality of penning and stressing the animals for treatment, it is seldom done.

Deworming is best done with one of the modern, systemic drugs that kill inhibited larvae as well as adult worms. Some of the drugs are injectable, some can be poured on, and some are given orally. None is 100% efficacious in every animal, but if used as directed, are very good.

CONCLUSIONS

Are your range cattle wormy? Almost certainly, YES. More importantly, are they wormy enough to warrant deworming? During the grazing season, diagnostic egg counts of fresh feces that average above 50 to 100 eggs per gram should be considered significant, and consideration should be given to treatment, especially if any of the animals have diarrhea, dull hair coats or bottle jaw, or are not developing as they should. After the normal pasturage season, when larvae predominate in the gut, it is very difficult to assess the worm load or determine whether or not to treat. If a dead animal is available for necropsy examination, it could be suggestive, but may not be a true indicator, either way. Often it is a judgement decision that is made by an experienced producer, or his veterinarian.

Does deworming make “cents”? Definitely, if warranted by worm load and its effect on development and performance of the animals. Unfortunately, under the diagnostic limitations noted, it is not always possible to determine if or when deworming is necessary, and the opinions of animal health specialists vary. Most advocate using one of the systemic dewormers after the grazing season, when transmission is reduced and inhibited *Ostertagia* larvae are reaching high levels, and again, just before turn-out, to delay pasture contamination.

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